73rd MORSS CD Cover Page

712CD

For office use only 41205

UNCLASSIFIED DISCLOSURE FORM CD Presentation

21-23 June 2005, at US Military Academy, West Point, NY

Please complete this form 712CD as your cover page to your electronic briefing submission to the MORSS CD. Do not fax to the MORS office.

Author Request **(To be completed by applicant) - The following author(s) request authority to disclose the following presentation in the MORSS Final Report, for inclusion on the MORSS CD and/or posting on the MORS web site.**

Name of Principal Author and all other author(s):
Michael Thompson

Principal Author's Organization and address:
Naval Surface Warfare Center Panama City
Code A84
110 Vernon Avenue
Panama City, FL 32407

Phone: 850-235-5063

Fax: 850-235-5082

Email: michael.h.thompson@navy.mil

Original title on 712 A/B: Simulation and Analysis Support of Counter Mine/ Counter Obstacle System Development

Revised title: same

Presented in (input and Bold one): (WG 13, CG___, Special Session ___, Poster, Demo, or Tutorial):

This presentation is believed to be:
UNCLASSIFIED AND APPROVED FOR PUBLIC RELEASE

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 JUN 2005	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Simulation and Analysis Support of Counter Mine/Counter Obstacle System Development	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Surface Warfare Center Panama City Code A84 110 Vernon Avenue Panama City, FL 32407**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

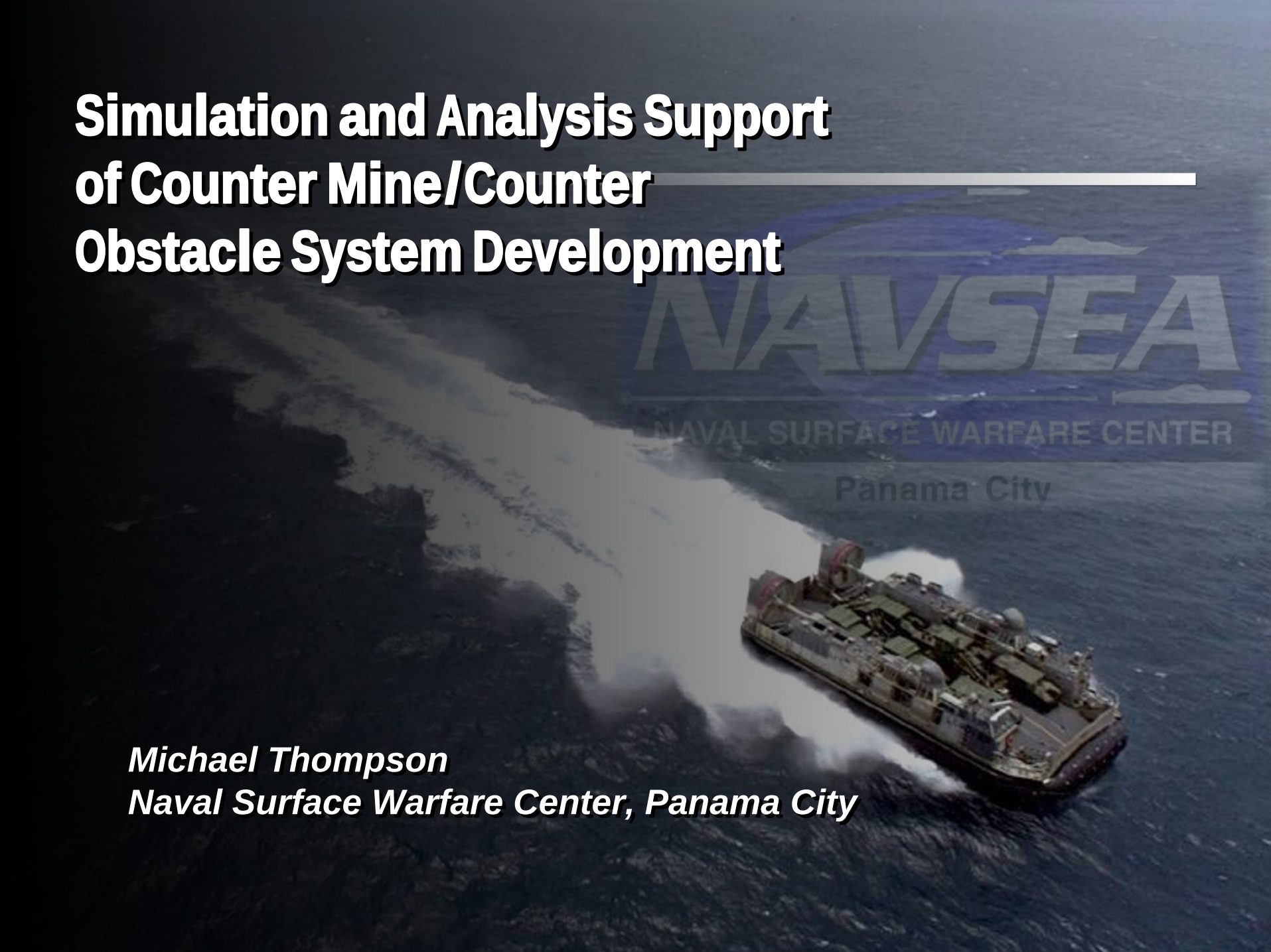
13. SUPPLEMENTARY NOTES
See also ADM201946, Military Operations Research Society Symposium (73rd) Held in West Point, NY on 21-23 June 2005 . , The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**20**	

Simulation and Analysis Support of Counter Mine/Counter Obstacle System Development

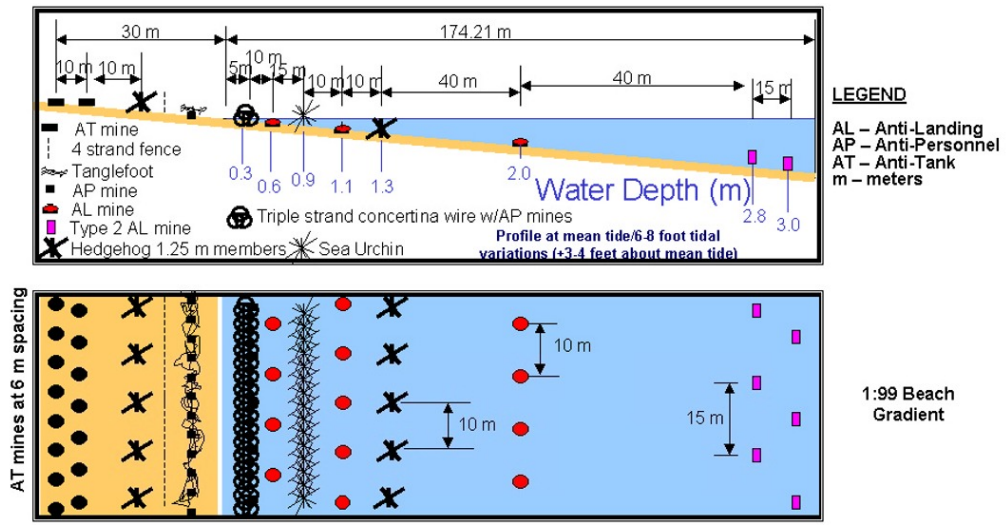


Michael Thompson
Naval Surface Warfare Center, Panama City

Brief Structure

The Problem

- **Threats to Amphibious Operations**
  - **Anti-Tank, Landing and Personnel Mines**
  - **Wire and obstacles**
  - **Hard to defeat in the BZ/SZ**
  - ***Quick, easy, cheap and effective***



Threat Demonstration

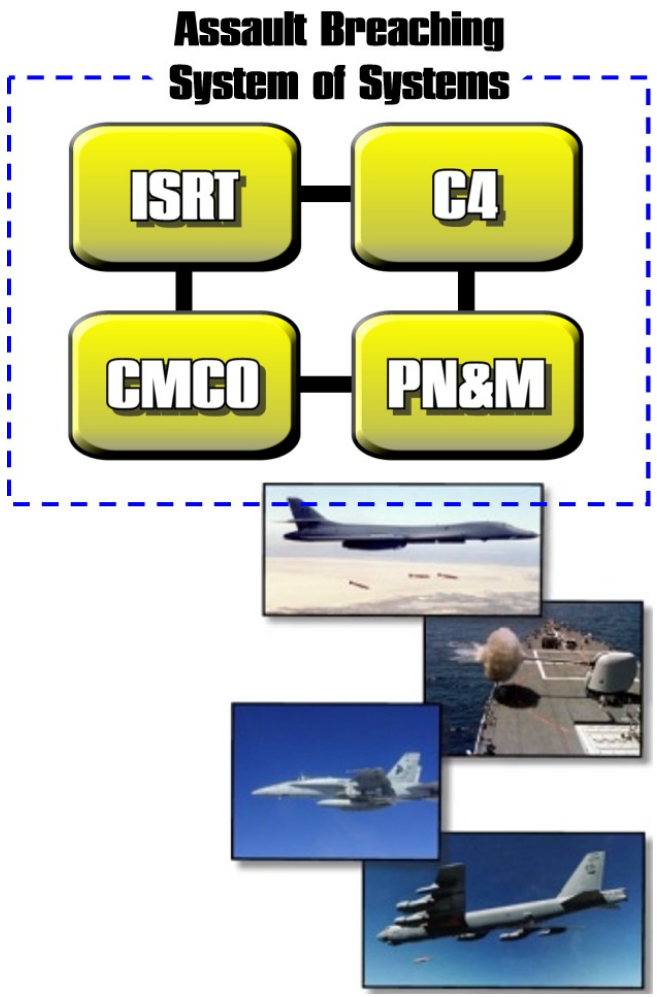
- **Amphibious Assault Vehicle (AAV) vs. PDM-2B mine**
  - **AAV floating & restrained in a test pond; no armor installed**
  - **PDM-2B is a Bulgarian moored mine with approximately 35 lbs. of cast TNT**
  - **Mine tethered to the bottom of pond & floated 10 feet above the bottom & just beneath the chin of the AAV, a realistic position for the encounter**
  - **PDM-2B fuze not used in this test; event was electrically initiated**

AAV vs. PDM-2B Results

If we can't overcome the Surf/Beach Zone threat, the STOM concept is unobtainable.

Solution - ABSoS

- Assault Breaching System of Systems (ABSoS)
  - ISRT – Intelligence, Surveillance, Reconnaissance and Targeting
  - C4 – Command, Control, Communications and Computers
  - *CMCO – Counter Mine, Counter Obstacle*
  - PN&M – Precision Navigation and Marking



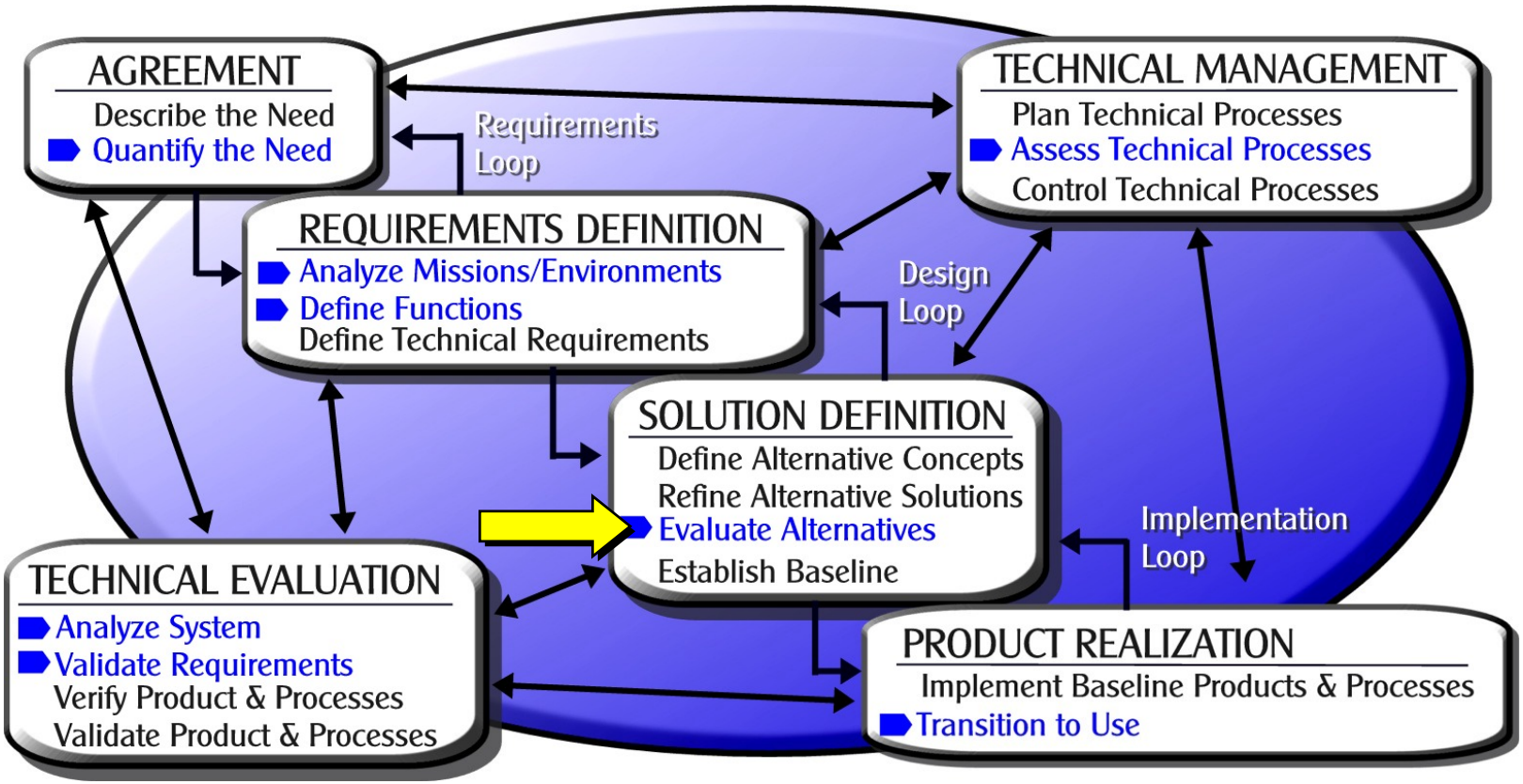
- CMCO System Objectives
  - Neutralize mines and obstacles in the
    - Surf zone (SZ): 10-foot water depth to high water mark (HWM)
    - Beach zone (BZ): HWM to beach exit
  - Stand-off delivery of the CMCO warheads

CMCO Candidate Systems

- **Near-Term Effort (FY06 Goal)**
  - **Joint Direct Attack Munition (JDAM) Assault Breaching System (JABS)**

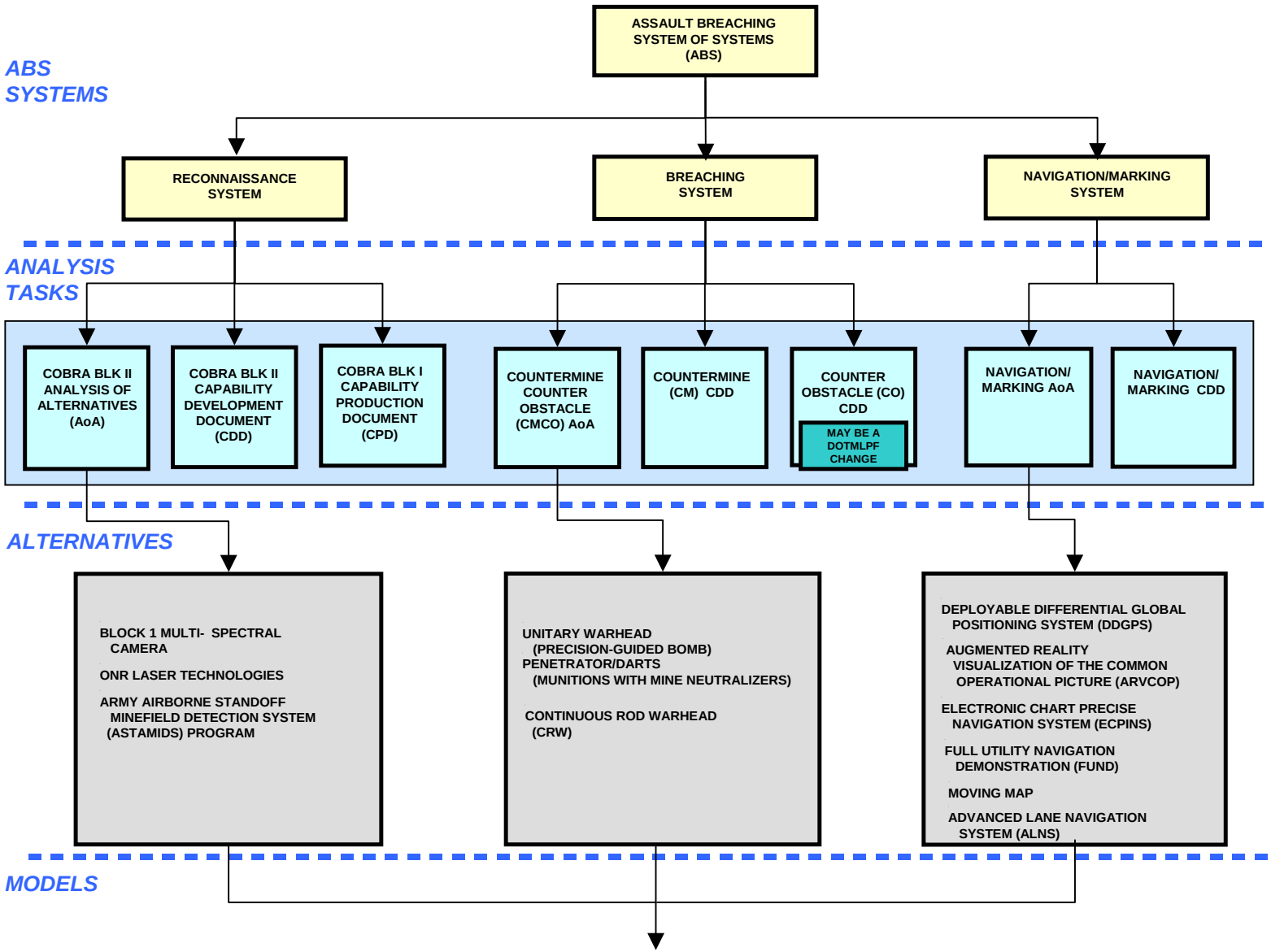
- **Mid-Term Concepts (FY15)**
  - **Three under evaluation**
    - **Two air-dropped**
    - **One naval gun-launched**
  - **Chemical or explosive penetrators against mines in the SZ and BZ**
  - **JABS continues as the counter-obstacle weapon**

Warfare Analysis in System Engineering

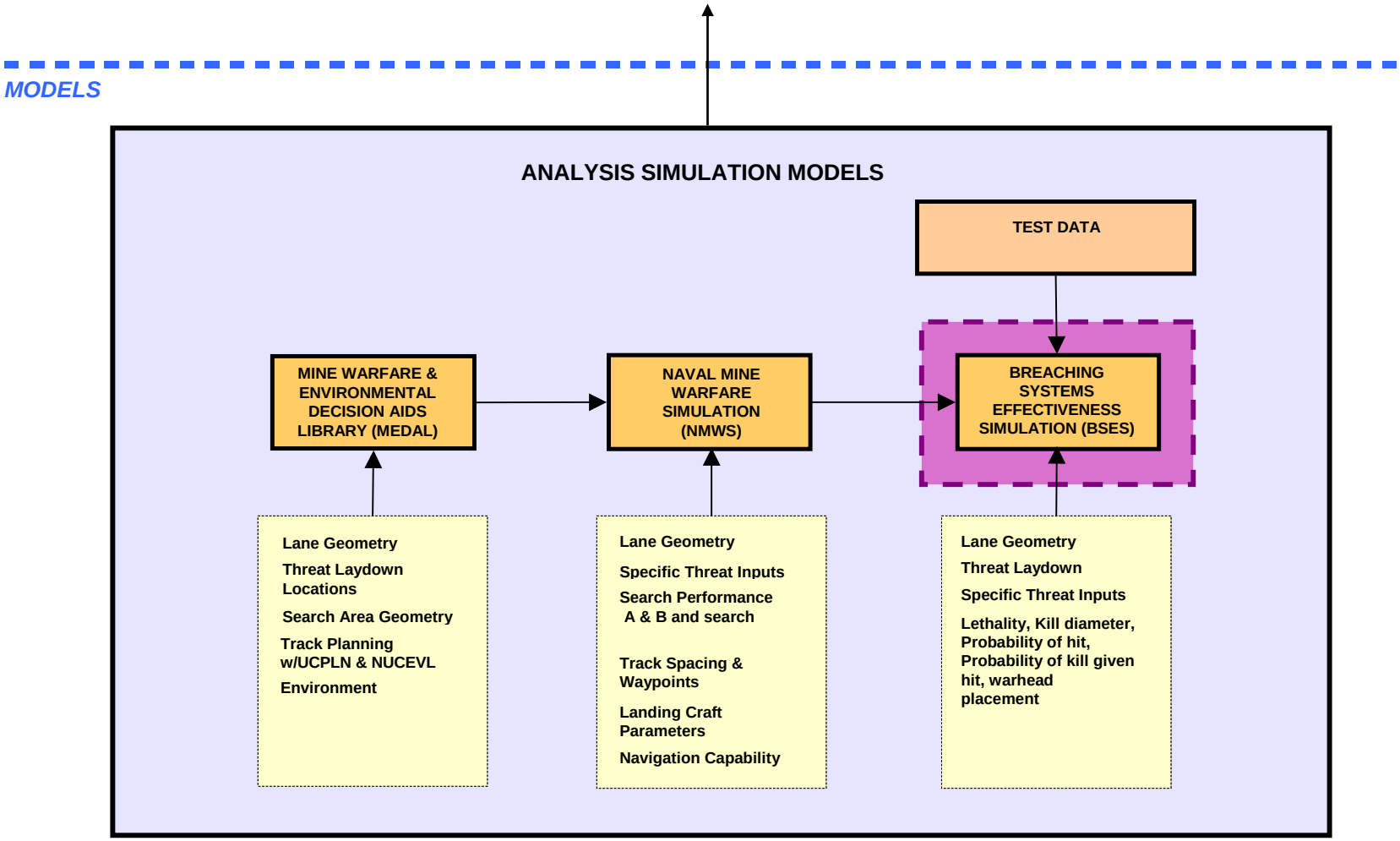


Blue highlights are simulation supportable activities.

ABS Analysis Approach



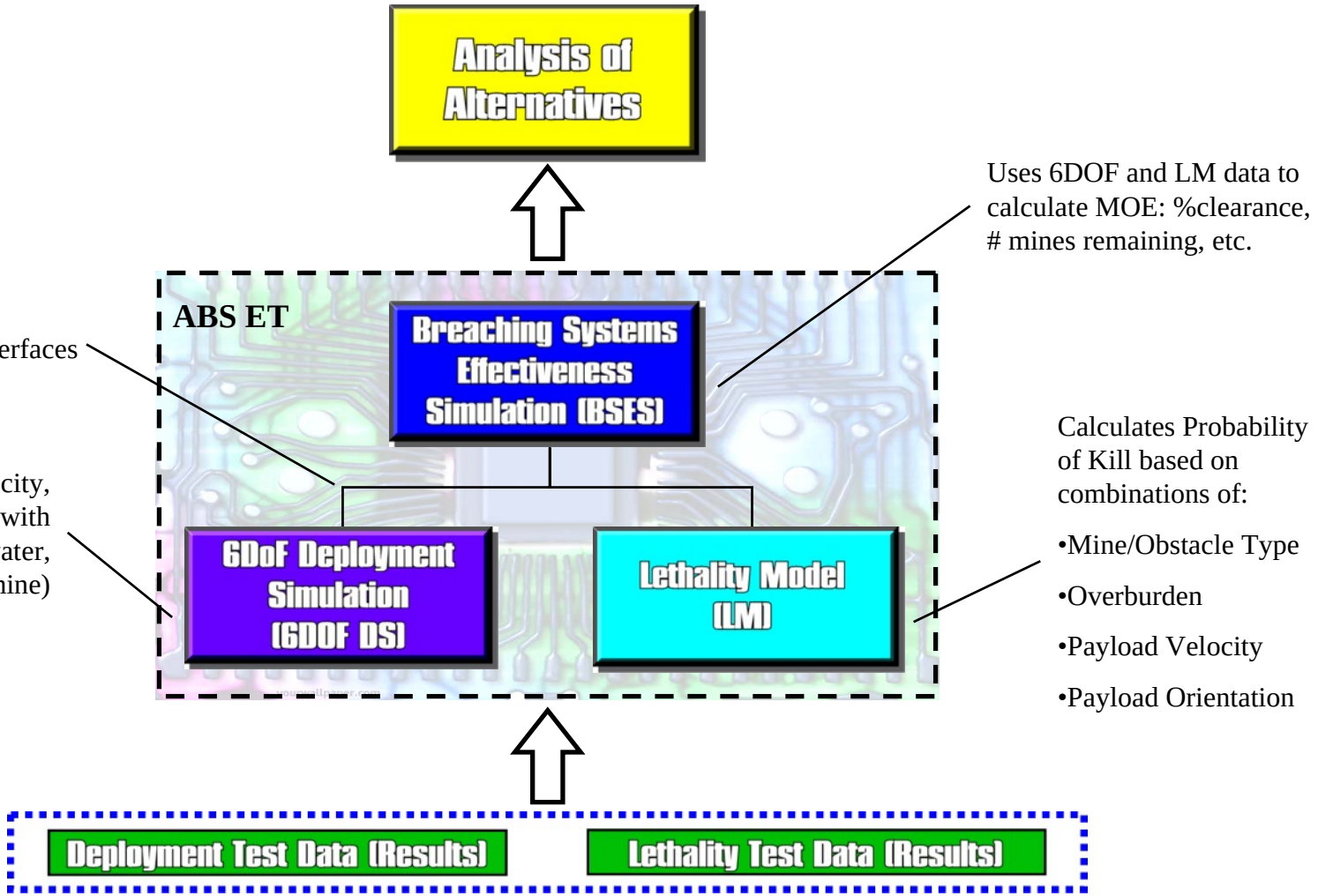
ABS Analysis Approach (cont.)



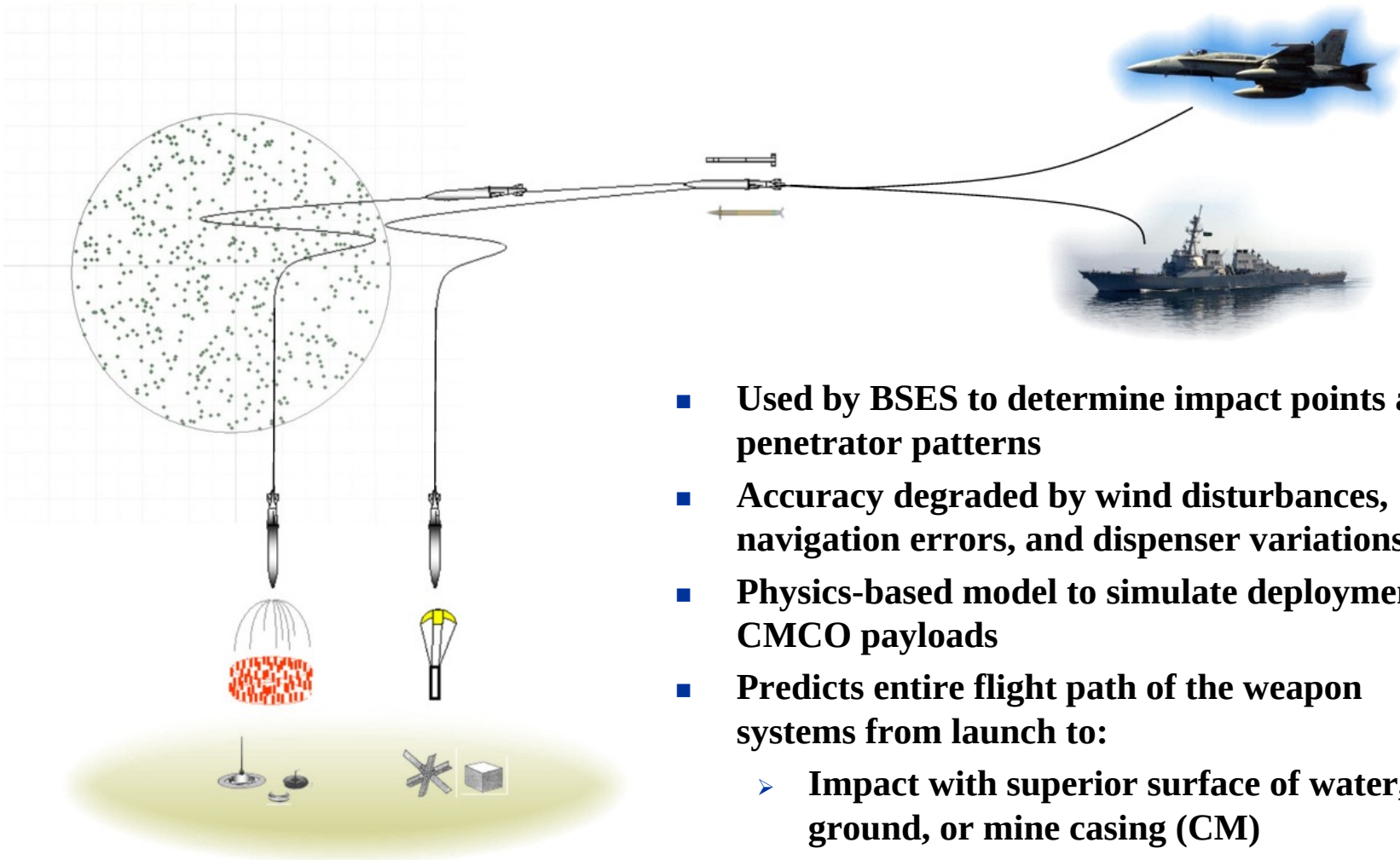
Simulation Goals

- **Primary Goals:**
  1. **To provide a simulation toolset by which analysts may perform Analysis of Alternative (AoA) studies for development of the Assault Breaching System of Systems (ABSoS) concept.**
  2. **To assist analysts and engineers in analyzing far term shallow water mine countermeasure systems in the Research Development Testing and Evaluation (RDT&E) phase for effectiveness against mine and obstacle threats in the Surf and Beach Zones.**
  3. **To be adaptable and extensible in support of future AoA and planning tasks.**

ABS Effectiveness Toolset Concept



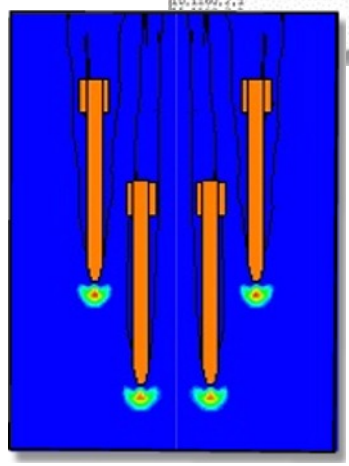
6DOF Model

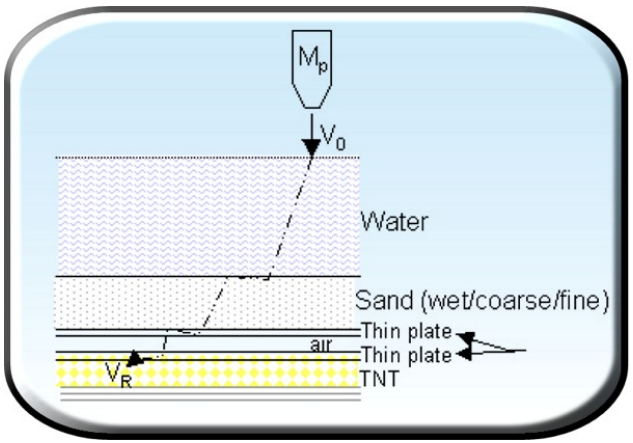


- Used by BSES to determine impact points and penetrator patterns
- Accuracy degraded by wind disturbances, navigation errors, and dispenser variations
- Physics-based model to simulate deployment of CMCO payloads
- Predicts entire flight path of the weapon systems from launch to:
  - Impact with superior surface of water, ground, or mine casing (CM)
  - Reaching burst height (CO)

Lethality Model

- Used by BSES to determine mine kills
- Set of P_k Lookup Tables for every Penetrator, Mine, & Overburden Combination
- Generated with Physics-based VENPEN Penetration Model
  - Library of Penetrator Shapes
  - Updated Material Library: Coarse Sand, Concrete & Brick
  - Super Cavitation Model: Cavitational Effects on Adjacent Darts
- Based on Results of Lethality Testing





The BSES Model

Mission Definition

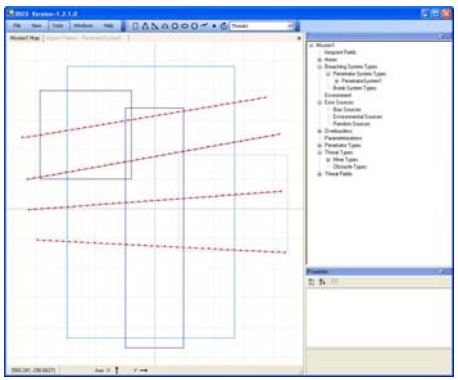
-Threat types, locations and overburdens
-Bomb and penetrator type
-Weapon error budget
-Impact patterns (6DOF)
-Lethality data (Lethality Model)
-Lanes
-Aim points

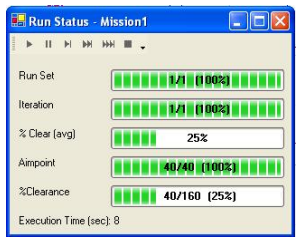
Simulation Iterations

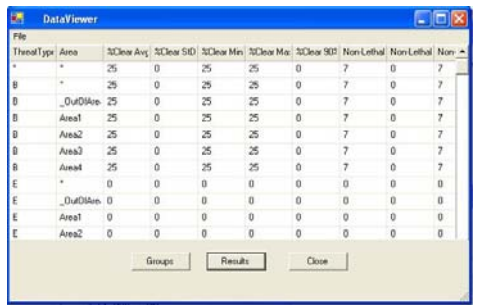
-Monte Carlo
-Uncertainty in Threat location
-Apply error and reliability probabilities to aim points
-Aim point interaction with threats
-Determine lethality
-Record hits and kills

Reporting & Analysis

-Data viewer
-Processing and correlation as defined by analyst's needs
-Supports AoA tasks

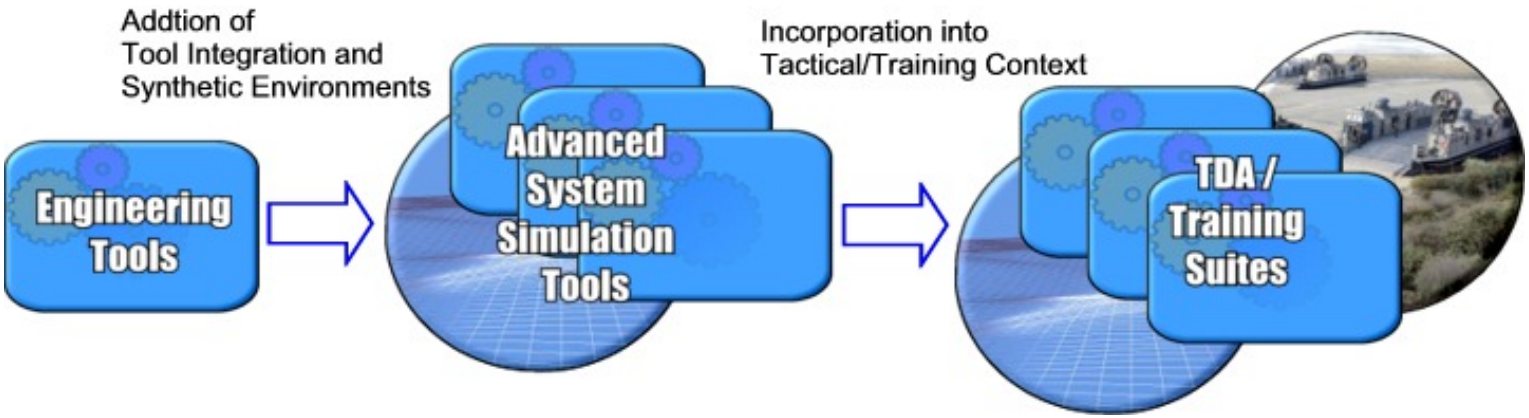






Parametrically driven models are flexible enough to support new operational and system experimentation.

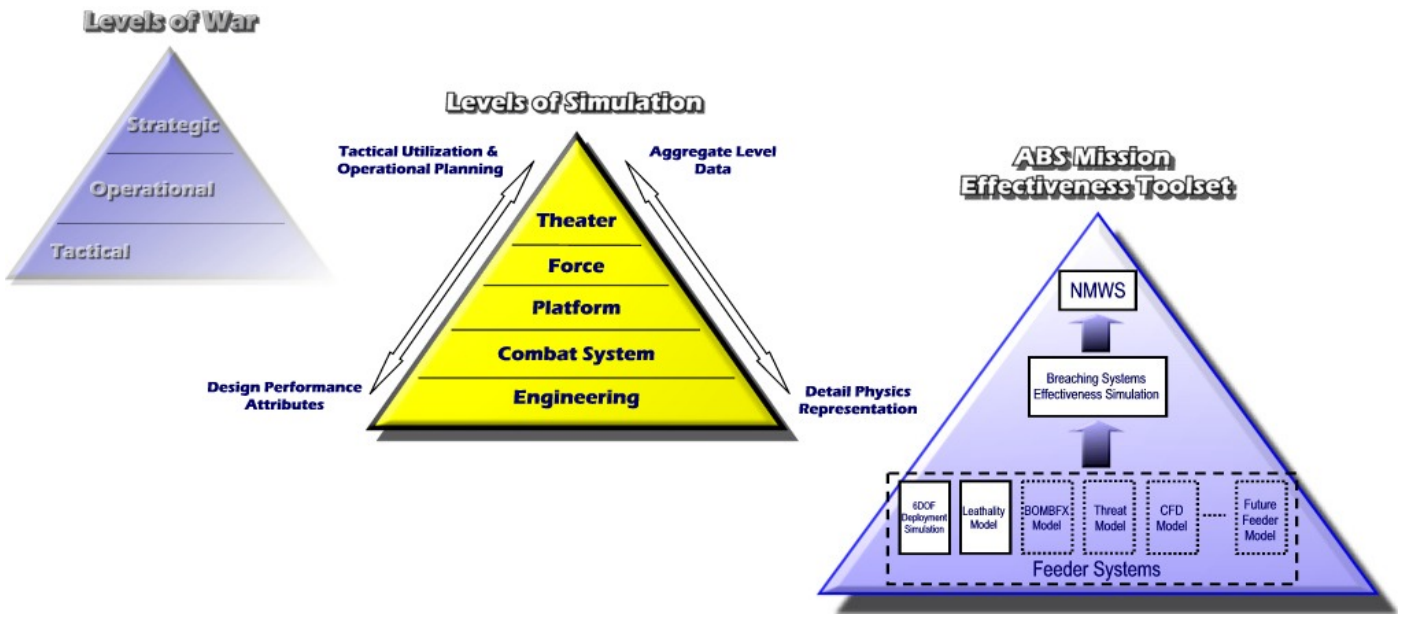
TDA/Training Support



- **Built on high fidelity physics-based engineering models to describe the behavior of the sub-systems.**
- **Integration and emersion into a synthetic environment to create advanced simulation tool sets that are used for AoA and CONOPS studies.**
- **Models may be leveraged in to tactical decision aids and training suites by the incorporation of situational context and rules.**

Lower-level simulations are integrated together as building blocks toward higher-level capabilities.

Higher Level Simulation Support



While the initial use will be that of an analysis tool for comparison of all far-term system concepts during the AOA, the 6DOF DS and Lethality Models are two of many possible "Feeder Systems" that may add input into the BSES at a future date. BSES will then, in turn, be used as a feeder system into the theater level Naval Mine Warfare Simulation.

ROI?

As an example, one live-fire test incurred more expense than all of BSES development and provided minimal statistical certainty. However, live-fire testing is still needed to validate models.

	Live-Fire Test	BSES
COST	- China Lake Range preparations - Pond in the desert - Safety - B-52s - Weapon Systems - Targets - Logistics	- Initial development cost - Minimal labor and hardware support
QUALITY	- Minimal environmental control - Geographically limited	- Complete control of test environments - No geographic/political/safety/cost/schedule restraints on test scenarios

Validated simulation models allow unrestricted test scenarios while maintaining complete control of mission parameters.

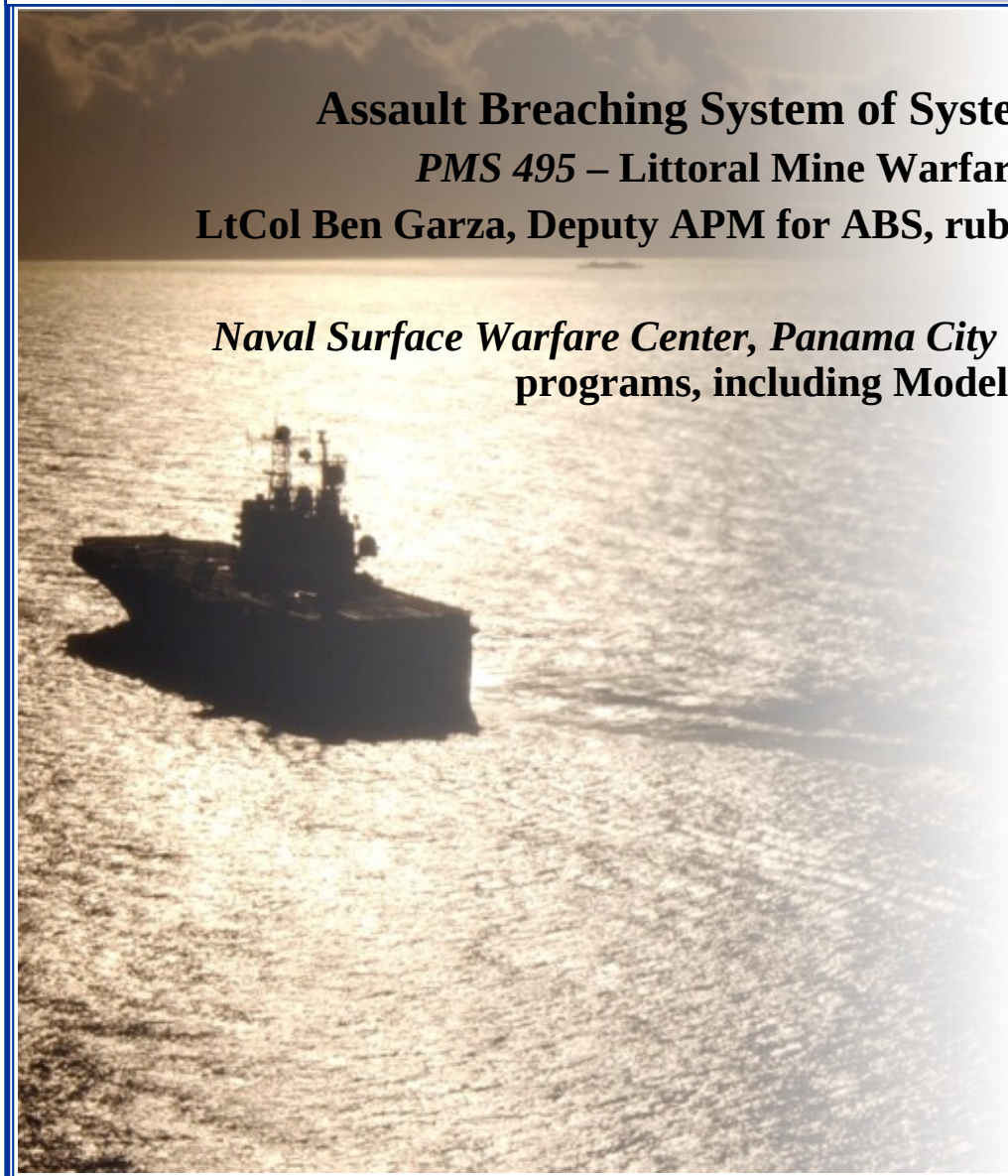
Contact Information

Assault Breaching System of Systems Program Management:

***PMS 495* – Littoral Mine Warfare, Surface Mine Warfare**

LtCol Ben Garza, Deputy APM for ABS, ruben.j.garza@navy.mil , (202) 781-4457

***Naval Surface Warfare Center, Panama City* - Technical Direction Agent for ABS programs, including Modeling and Simulation.**



Michael Thompson
NSWC PC
850-235-5063
michael.h.thompson@navy.mil